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High-strength and high-conductivity Cu-(Ni, Co)-Si copper alloy for use in leadframes and method of making the same

Patent Number:

Publication date: 2001-08-01

Inventor(s): LEE I-CHING (TW); LIU JIN-YAW (TW); LIU RAY-IUN (TW); SHA YU-LIAN (TW); TENG MAO-YING (TW)

Applicant(s): IND TECH RES INST (TW)

Requested Patent: TW448235

Application Number: TW19980121944 19981229

Priority Number(s): TW19980121944 19981229

IPC Classification: C22C9/06; C21D8/12

EC Classification:

Equivalents:

Abstract

A high-strength and high-conductivity copper alloy is disclosed which contains essentially of: (a) from 0.5 to 2.5 wt% of Ni; (b) from 0.5 to 2.5 wt% of Co; (c) from 0.5 to 0.8 wt% of Si; (d) from 0.05 to 0.15 wt% of either Mg or P or both; and (e) the balance of Cu. The amounts of Co, Fe, Ni, and Si satisfy the following equations: $2\% \leq (\text{Ni} + \text{Co}) \leq 4\%$, and $0.8 \leq (\text{Ni}/4 + \text{Co}/6)/\text{Si} \leq 1.2$. The new copper alloy exhibits substantially improved electrical conductivity, greater than 45% IACA, than the commercially available C7025 copper alloy, while maintaining a satisfactory tensile strength (greater than 600 MPa), and, thus, can be most advantageously used for preparing leadframes for use in high pin-number (greater than 100 pins) IC application.

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中華民國專利公報 [19] [12]

[11]公告編號：448235

[44]中華民國 90年(2001) 08月01日

VIA FACSIMILE

發明

DEC 03 2002

全 3 頁



[51] Int.Cl. 05: C22C9/06

C21D8/12

台灣時報 No. 90112482 引例 2 之全文
 號: P1437 TW

[54]名稱：高強度高導電率之引線架連接器用銅合金及其製作方法

[21]申請案號：087121944

[22]申請日期：中華民國 87年(1998) 12月29日

[72]發明人：

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[74]代理人：

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[57]申請專利範圍：

1.一種銅合金，基本上含有下列成分：

(a)銀含量介於0.5-2.5wt%之間；

(b)鈷含量介於0.5-2.5wt%之間；

(c)矽含量介於0.5-0.8wt%之間；

(d)鎂或磷或二者的含量介於0.05-0.15wt%之間；及

(e)剩餘量為銅；

(f)其中鈷、銀及矽的含量滿足下列方程式： $2\% < (\text{銀} + \text{鈷}) < 4\%$ 及 $0.8 < (\text{銀}/4 + \text{鈷}/6)/\text{矽} < 1.2$ 。

2.如申請專利範圍第1項之銅合金，其基本成分包含：0.5wt%-2.5wt%的銀、0.5wt%-2.5wt%的鈷、0.4wt%-0.8wt%的矽、0.05wt%-0.15wt%的(鎂和/或磷)、及剩餘量為銅，其中銀和鈷的總量介於2.0和4.0wt%之間。

3.如申請專利範圍第1項之銅合金，其抗張強度至少為600Mpa且導電率至少為45%IACS。

4.一種製備銅合金的製程，由下列步驟

所組成：

(a)金屬混合物基本上包含下列成分：

(i)銀含量介於0.5-2.5wt%之間；

(ii)鈷含量介於0.5-2.5wt%之間；

(iii)矽含量介於0.5-0.8wt%之間；

(iv)鎂或磷或二者的含量介於0.05-0.15wt%之間；

(vi)其中鈷、銀及矽的含量滿足下列方程式： $2\% < (\text{銀} + \text{鈷}) < 4\%$ 及 $0.8 < (\text{銀}/4 + \text{鈷}/6)/\text{矽} < 1.2$ 。

(b)利用高週波爐熔化組成金屬，然後快速冷卻鑄成所需大小的鑄錠；

(c)將鑄錠於800-950℃進行0.5-6小時之均質化處理；

(d)均質化後之鑄錠直接進行熱加工使之形成銅合金板片，加工量為70%或更高，該合金板片必要時可視情況於800-950℃進行30秒到30分鐘之退火熱處理使之軟化，或直接進行(c)步驟之冷軋；

(2)

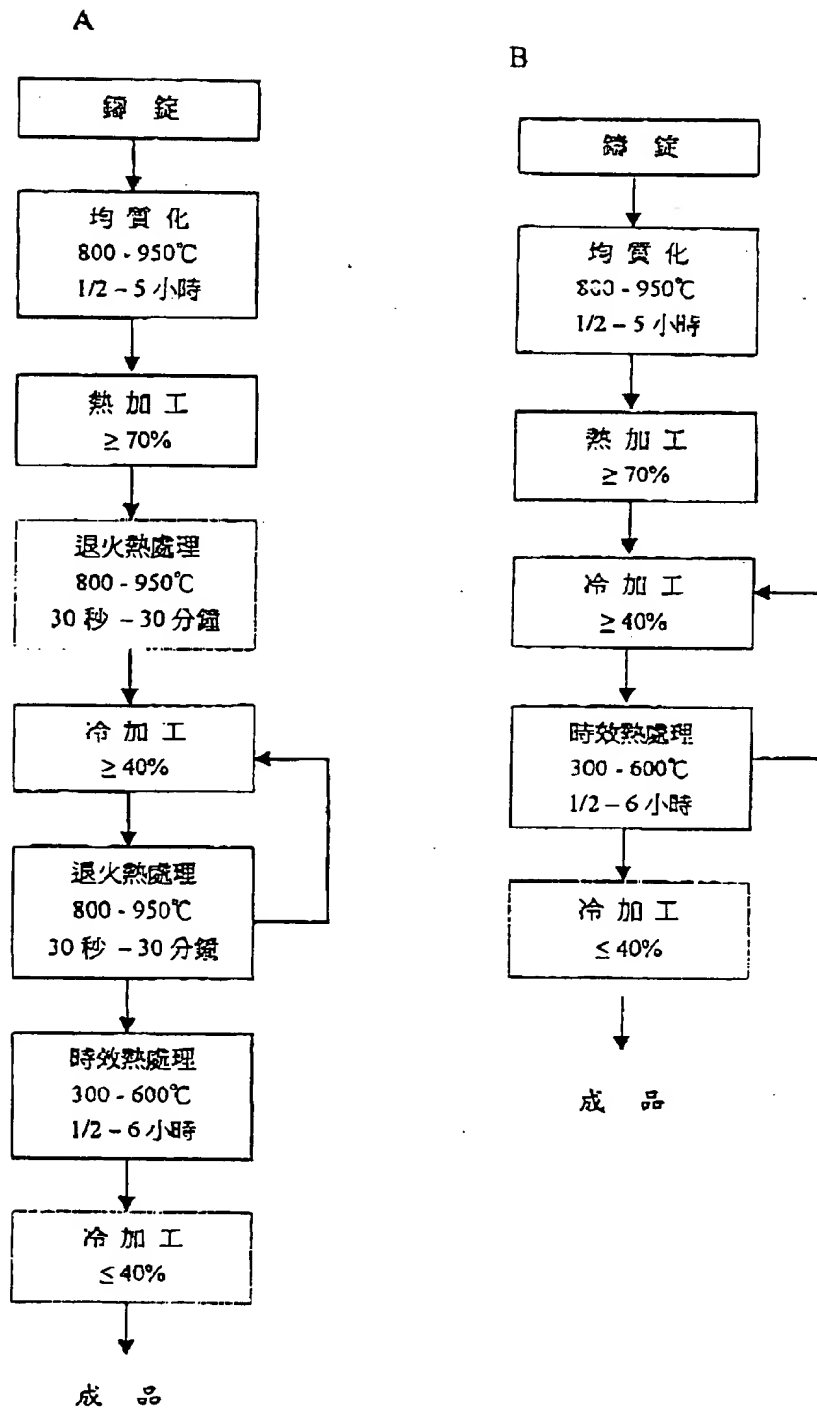
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- (e)板片進行冷軋，冷軋量須達40%以上；
- (f)冷軋後銅合金板片於800-950℃進行30秒至30分鐘之退火熱處理；
- (g)步驟(c)及(f)可重複實施直到板片達到所需之厚度及導電率等特性；及
- (h)最後一次冷軋後之合金板片，於300-600℃進行30分鐘至5小時之時效熱處理。
- 5.如申請專利範圍第4項所述之製備銅合金的製程，其中，金屬混合物基本成分包含：0.5wt%-2.5wt%的鎳、0.5wt%-2.5wt%的鈷、0.4wt%-0.8wt%的矽、0.05wt%-0.15wt%的(鎂和/或磷)、及剩餘量為銅，其中鎳和鈷的總量介於2.0和4.0wt%之間。
- 6.如申請專利範圍第4項所述之製備銅合金的製程，其中，進一步包含銅合金板片於時效熱處理後之冷加工。
- 7.一種製備銅合金的製程，由下列步驟所組成：
- (a)金屬混合物基本上包含下列成分：
- (i)鎳含量介於0.5-2.5wt%之間；
- (ii)鈷含量介於2.5-2.5wt%之間；
- (iii)矽含量介於0.5-0.8wt%之間；
- (iv)鎂或磷或二者的含量介於0.05-0.15wt%之間；
- (v)剩餘量為銅；
- (vi)其中鈷、鎳及矽的含量滿足下列方程式： $2\% < (\text{鎳} + \text{鈷}) < 4\%$ 及 $0.8 < (\text{鎳}/$

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- $4 + \text{鈷}/6) / \text{矽} < 1.2$ ；
- (b)利用高週波爐熔化組成金屬，然後快速冷卻鑄成所需大小的鑄錠；
- (c)將此熱鑄錠於80-950℃進行0.5-5小時之均質化熱處理；
- (d)均質化後之鑄錠直接進行熱加工使之形成銅合金板片，加工量為70%或更高；
- (e)熱加工後銅合金板片進行冷加工，冷加工量為至少40%或更高；
- (f)冷加工後於300-600℃進行時效熱處理使其析出硬化；及
- (g)步驟(d)及(e)可重複實施直到板片達到所需之厚度及導電率等特性。
10. 8.如申請專利範圍第7項所述之製備銅合金的製程，其中，金屬混合物基本成分包含：0.5wt%-2.5wt%的鎳、0.5wt%-2.5wt%的鈷、0.4wt%-0.8wt%的矽、0.05wt%-0.15wt%的(鎂和/或磷)、及剩餘量為銅，其中鎳和鈷的總量介於2.0和4.0wt%之間。
15. 9.如申請專利範圍第7項所述之製備銅合金的製程，進一步包含銅合金板片於最後一次時效熱處理後之額外冷加工。
20. 圖式簡單說明：
- 第一圖A為本發明高溫製程之主要步驟之流程圖。
25. 第一圖B為本發明低溫製程之主要步驟之流程圖。
- 30.

(3)



第一圖

9259



正本

經濟部智慧財產局專利核駁審定書

受文者：古河電氣工業股份有限公司（代理人：

杜漢淮 先生）

地址：台北市吉林路二十四號九樓之六

發文日期：中華民國九十一年十一月十三日

發文字號：（九一）智專二（六）01088字

第〇九一八三〇二〇三〇四號

一、申請案號數：〇九〇一一二四八二

二、發明名稱：電子電氣機器之組零件用銅合金材料

三、申請人：

名稱：古河電氣工業股份有限公司

地址：日本

四、專利代理人：

姓名：杜漢淮 先生

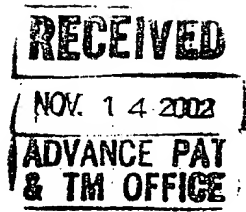
地址：台北市吉林路二十四號九樓之六

五、申請日期：九十年五月二十四日

六、優先權項目：1 2000/07/25 日本2000-224425

七、審查人員姓名：倪國裕 委員

專利分類IPC(7)：...C22C 9/00



12/14



八、審定內容：

主文：本案應不予專利。

依據：專利法第二十條第二項。

理由：

(一) 本案「電子電氣機器用銅合金材料」係由Ni-1.0-3.0、Si-0.2-0.7、Mg-0.01-0.2、Sn-0.05-1.5、Zn-0.2-1.5、 $S < 0.005$ 之銅合金，並具特定之晶粒0.001-0.025mm且塑變平行與重直方向徑長比 a/b 比為1.5其特定之塑性加工後表面粗度Ra-0.01微米。

(二) 經查前案資料US 5833920 (詳引證資料) 揭示鎳、矽、鋅及少量銀0.002-0.3%之合金；另中華民國專利第448235號 (詳引證資料) 揭示鎳、矽、鋅、鈷0.5-2.5%、鎂0.05-0.15%合金及於EP 0440548a (詳引證資料) 其鎳、矽、鋅、錫、鎂0.05-0.5%及少量鉻鈦鋯，故本案鎳、矽、鋅等與上述前案資料形成部分重疊，而鎂及錫則含量少可屬一般雜質範圍，雖增加硫 $< 5000\text{ppm}$ 之限制，但以合金成分來看，因部分重疊不符下位新穎原則；又本案申請標的為銅合金材係由成分及組織為特點，然本案合金範圍與前案資料部分重疊並非一獨特之合金系，而均勻組織是一般材料期望之結果，本案發明內容並未對達成此一結果途徑作明確說明，無法判知是否有特殊技術所在；就冶金材料專業來看，本案所提之 a/b 比值只在製作一般板片材時控制兩方向之軋延量，在一般期望組織均勻時，比值接近1為理想，本案合金系所增提之 a/b 值於0.8-1.5不具特殊性，再者，本案細緻表面為

一般所求，不見特殊方法，只是增加設定表面光度值，故本案合金系與前案資部分重疊，並非一新合金系，雖以增加組織控制在一定 α/β 值範圍之條件不同於前案，惟此組織控制屬習知可輕易推知，故本案應用申請前既有之技術或知識，為熟習該項技術者所能輕易達成者，不具進步性。

(三) 本案說明書表5之「鍍層有無耐蝕性」欄中「無」是負面結果應為誤植；又實施例A-2中各試片均未將表粗度予以說明，表2之晶粒及 α/β 比均屬內部性質，在缺少粗度資料下，試件13之鍍層性差有可能是表質造成，申請專利範圍第2項與第1項相比只有成分上在Cu、Co、Ag等略有差異，因發明內容及實施例中未揭示因此元素之添加產生獨立之效果，故第2項屬第1項之延伸性發明，第3項取消了晶粒粒度及形狀之說明改以粗度表示，由實施例A組與B組之熔、軋程序相同可知試片晶粒及形狀屬相同，故第3項實質上為第1項之延伸，應依附於第1項，同理第3項也應附屬於第1或3項發明；以上不明確，併予指明。

據上論結，本案不符法定專利要件，爰依專利法第二十條第二項，審定如主文。

局長 蔡練生

依照分層負責規定授權單位主管執行

如不服本審定，得於文到之次日起三十日內，備具再審查理由書一式二份及規費新台幣陸仟元整（專利說明書及圖式合計在五十頁以上者，每五十頁加收新台幣五百元，其不足五十頁者以五十頁計），向本局申請再審查。

摘要: Multi-cavity injection molding apparatus having two heated manifolds interconnected by a connector bushing all extending in a common plane. A threaded portion of the connector bushing is screwed into a threaded opening in one manifold and a nonthreaded portion of the connector bushing is received in a nonthreaded opening in the other manifold. The nonthreaded portion of the connector bushing fits in the nonthreaded hole in the other manifold tightly enough to prevent melt leakage, but is still able to slide sufficiently in the opening to accommodate thermal expansion and contraction of the heated nozzles relative to the cooled manifold in which they are mounted and located. In one embodiment, the connector bushing is made of a material such as a beryllium copper alloy having a greater coefficient of expansion than the steel manifolds so it can be easily installed and then expand to produce this fit when heated to the operating temperature.

專利範圍: In an injection molding apparatus having spaced first and second heated manifolds interconnected by an elongated connector bushing, the first and second heated manifolds and the connector bushing mounted in a common plane in a mold with a melt passage extending from the first heated manifold through the connector bushing into the second heated manifold, the improvement wherein; the connector bushing has a first cylindrical portion extending from a first end, a second cylindrical portion extending from a second end, and a melt bore extending therethrough from said first end to said second end, the first portion being received in a first cylindrical opening aligned with the melt passage in the first heated manifold, the second portion being received in a second cylindrical opening aligned with the melt passage in the second heated manifold, at least one of the first and second cylindrical portions of the connector bushing fitting in one of the first and second cylindrical openings in the heated manifold to allow the at least one cylindrical portion of the connector bushing to slide sufficiently in said one of the cylindrical openings to allow for thermal expansion and contraction of the manifolds and connector bushing without allowing leakage of pressurized melt flowing through the melt passage.

美國專利分類號: 425/572 ;425/588

國際專利分類號: B29C-045/22

引用專利: 4219323 ;4761343 ;5366369

參考國外文獻: WOX 199501 WO9500312

優先權項: CAX 19960705 2180603

審查委員: Heitbrink, Tim

代理人: Dalesman & Company

指定州別: CAX

說明書: 5720995

第 6/29 筆 of US patent 1996-1998

專利編號: 5833920

專利名稱: Copper alloy for electronic parts, lead-frame, semiconductor device and connector

公告日: 19981110

專利申請日: 19970219

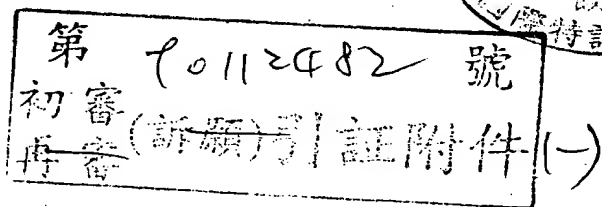
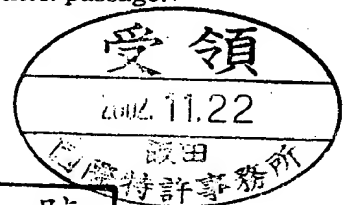
專利申請號: 802868

發明人: Nakanishi, Teruo ;Maeda, Akira ;Watanabe, Mikio ;Kawahata, Toshikazu ;Kurita, Toshihiro ;Kubozono, Kenji

專利權人: Mitsubishi Denki Kabushiki Kaisha ;Mitsubishi Electric Metecs Co., Ltd.

摘要: The present invention provides a copper alloy for electronic part which is excellent in adhesion of silver (Ag) and reliability of solderability and adhesion of plating without impairing excellent strength and electrical conductivity of a copper-nickel-silicon alloy. The copper alloy for electronic parts in the present invention consists essentially of 1.7 to 4.0% by weight of nickel, 0.3 to 0.8% by weight of silicon, 0.002 to 0.3% by weight of silver, 0.5 to 2.0% by weight of zinc, and a residual of copper.

專利範圍: A copper alloy for electronic parts, which consists essentially of 1.7 to 4.0% by weight of nickel, 0.3 to 0.8% by weight of silicon, 0.002 to 0.3% by weight of silver, 0.5 to 2.0% by weight of zinc and a



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[11]公告編號：448235

[44]中華民國 90年 (2001) 08月 01日
發明

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[51] Int.Cl 06: C22C9/06
C21D8/12

[54]名稱：高強度高導電率之引線架連接器用銅合金及其製作方法

[21]申請案號：087121944

[22]申請日期：中華民國 87年 (1998) 12月 29日

[72]發明人：

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[74]代理人：

1

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[57]申請專利範圍：

1. 一種銅合金，基本上含有下列成分：

- (a) 鎳含量介於 0.5-2.5wt% 之間；
- (b) 鈷含量介於 0.5-2.5wt% 之間；
- (c) 矽含量介於 0.5-0.8wt% 之間；
- (d) 鎂或磷或二者的含量介於 0.05-0.15wt% 之間；及
- (e) 剩餘量為銅；
- (f) 其中鈷、鎳及矽的含量滿足下列方程式： $2\% < (\text{鎳} + \text{鈷}) < 4\%$ 及 $0.8 < (\text{鎳} / 4 + \text{鈷} / 6) / \text{矽} < 1.2$ 。

2. 如申請專利範圍第 1 項之銅合金，其基本成分包含：0.5wt%-2.5wt% 的鎳、0.5wt%-2.5wt% 的鈷、0.4wt%-0.8wt% 的矽、0.05wt%-0.15wt% 的(鎂和/或磷)、及剩餘量為銅，其中鎳和鈷的總量介於 2.0 和 4.0wt% 之間。

3. 如申請專利範圍第 1 項之銅合金，其抗張強度至少為 600Mpa 且導電率至少為 45%IACS。

4. 一種製備銅合金的製程，由下列步驟

所組成：

- (a) 金屬混合物基本上包含下列成分：
 - (i) 鎳含量介於 0.5-2.5wt% 之間；
 - (ii) 鈷含量介於 0.5-2.5wt% 之間；
 - (iii) 矽含量介於 0.5-0.8wt% 之間；
 - (iv) 鎂或磷或二者的含量介於 0.05-0.15wt% 之間；
 - (vi) 其中鈷、鎳及矽的含量滿足下列方程式： $2\% < (\text{鎳} + \text{鈷}) < 4\%$ 及 $0.8 < (\text{鎳} / 4 + \text{鈷} / 6) / \text{矽} < 1.2$ 。

10.

(b) 利用高週波爐熔化組成金屬，然後快速冷卻鑄成所需大小的鑄錠；

(c) 將鑄錠於 800-950℃ 進行 0.5-6 小時之均質化處理；

15.

(d) 均質化後之鑄錠直接進行熱加工使之形成銅合金板片，加工量為 70% 或更高，該合金板片必要時可視情況於 800-950℃ 進行 30 秒到 30 分鐘之退火熱處理使之軟化，或直接進行(c)步驟之冷軋；

20.

第 903 號
初審
再審
90112482 號
(新)引証附件(=)

TTSWeb:智慧財產局國外專利全文系統:歐洲專利資料庫 (967438筆)--顯示詳目

檢索策略 \$1 (12筆)(COPPER ALLOY AND CONNECTOR ... 顯示結果 (自第 1 筆開始)

共 12 筆, 本頁顯示第 7 至 7 筆 每頁 10 筆 清除註記 開啓選項

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專利編號: EP0440548 A2 19910807

EP0440548 A3 19931208

專利名稱: Migration-resistant copper alloy for terminal and connector uses having excellent spring characteristics, strength and conductivity

公開日: 19910807

專利申請日: 19910129

專利申請號: EP91400200 19910129

發明人: Miyafuji, Motohisa ;Hosokawa, Isao

專利權人: KABUSHIKI KAISHA KOBE SEIKO SHO also known as Kobe Steel Ltd.

摘要: Disclosed herein is a migration-resistant copper alloy for terminal and connector uses having excellent spring characteristics, strength and conductivity which contains 0.4 to 4.0% by weight of Ni, 0.1 to 1.0% by weight of Si, 1.0% (exclusive) to 5.0% (inclusive) by weight of Zn, 0.05 to 0.5% by weight of Mg, 0.1 to 0.5% by weight of Sn, and 0.001% (inclusive) to 0.01% (exclusive) by weight of at least one of Cr, Ti and Zr, the balance being Cu and unavoidable impurities. The copper alloy is excellent in softening resistance, migration resistance, stress relaxation properties, corrosion resistance, etc. as well as spring characteristics, strength and conductivity, and is suitable for terminals and connectors.

國際專利分類號: H01R-013/03 ;H01B-001/02 ;C22C-009/06

優先權項: JP1971990 19900130

指定國家: FR ;GB ;NL

原文影像: EP.A2.0440548

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第
初審
再審
20112482 號
(註明)引証附件 (三)

Excerpted English Translation of Decision in 1st-Stage
Examination

(omitted)

Mailing Date

November 13, 2002

(omitted)

1. Application No.

90112482

2. Title of the Invention

Copper alloy material for
electronic and electrical
instrument parts

3. Applicant

Furukawa Electric Co., Ltd,
Japan

(omitted)

8. Contents of Decision

Formal Adjudication: The present application is
unpatentable.

Applied Articles: Article 20, Clause 2 of the Patent Law

Reason:

(1) This application is to claim a copper alloy material
for electronic and electrical instrument parts, wherein

the copper alloy contains Ni of 1.0-3.0, Si 0.2-0.7, Mg of 0.01-0.2, Sn of 0.05-1.5, Zn of 0.2-1.5 and S < 0.005, and has 0.001 to 0.025 mm of a specific diameter of crystal grain, the diameter b of the crystal grain in the cross section that makes a right angle with the plastic working direction and the diameter a of the crystal in the cross section parallel with the plastic working direction has the ratio a/b of 1.5 or less, and the surface roughness Ra after plastic working is 0-0.1 μm .

(2) After examination, it is found that a copper alloy comprising Ni, Si, Zn and a trace of Ag is disclosed in U.S. Patent No. 5,833,920 (Cited reference 1), a copper alloy comprising Ni, Si, Co of 0.5 to 2.5 % and Mg of 0.05-0.15% is disclosed in Taiwan Patent No. 448235 (Cited reference 2), and a copper alloy comprising Ni, Si, Zn, Sn, and Mg of 0.05-0.5%, and a trace of Cr, Ti and Zr is disclosed in EP 0440548A (Cited reference 3), respectively. Therefore, Ni, Si, Zn, etc. defined in the present application are duplicated partially with the above cited documents. And, although the Mg and Sn contents are small and are limited to S<5000ppm, which is in the range of ordinary foreign matter (impurities), they are partially duplicated in terms of the alloy composition, so the application does not conform to the novelty principle of subordinate concept. And the claimed subject matter of

the present application is a copper material and is characterized by the composition and structure, but the range of the alloy composition of the present application is partially duplicated with the above cited documents, and is not a unique alloy series. And the uniform structure is a desired result of ordinary materials, but the content of the present invention does not have clear description on how the result was achieved. Therefore, it is not possible to determine whether it has a special art. Viewed from the professional skill of metallurgical materials, the value of the a/b ratio proposed by the present application merely controls and specifies the rolling amount of both directions when processing and manufacturing plate materials, and when a uniform structure is desired, generally it is ideal to approximate this value to 1. The a/b value of 0.8 to 1.5 proposed in the alloy series of the present application has no speciality. And the elaborate surface required by the present application is a generally required one, and it is no more than merely improving the luminosity of the surface without any special method. Therefore, the alloy series of the present application is partially duplicated with the cited documents, and is not a novel alloy series. Although the a/b value is to be controlled (structure control) to a given range of condition, but this kind of

structure control can be easily conceived and accomplished by the person skilled in the art based on the publicly known skill and knowledge, so it has no unobviousness.

(3) Regarding the specification

1) "None" in the result of measuring "the existence of plating corrosion resistance" in Table 5 is a negative result, so I think it is an error in writing.

2) In the example A-2, there is no description on the surface roughness of each test piece.

3) The crystal grain size and a/b ratio in Table 2 all belong to internal property; and the test piece No. 13 has no data for surface roughness, so the cause for poor (×) plating tightness is considered to be by the surface property.

4) Claim 2 and Claim 1 have a little difference in Cr, Co, Ag, etc. in terms of composition. But in the examples, there is no mention on the unique effect generated by the addition of these elements. Therefore, Claim 2 is an invention having a character extended from Claim 1.

5) In Claim 3, the melting and rolling conditions of examples A and B, in which surface roughness has limiting factors of the grain size and shape change, are the same, so the grain size and shape of the test piece are the same. Therefore, Claim 3 is essentially an extension of Claim 1, and should be subordinated to Claim 1. For the same reason,

Claim 9 also is an invention subordinated to Claim 1 or Claim 3.

As a conclusion from the above, the present application does not meet the patent requirements. Therefore, in accordance with Article 20, Clause 2 of the Patent Law, it is decided, as in the formal adjudication.

(omitted)